

## CTIA Certification Program Working Group Liaison Statement

To	GSMA Terminal Steering Group Antenna Performance (TSGAP)
CC	3GPP TSG RAN4
Source	CTIA Over-the Air (OTA) Working Group
Subject	Response LS to Measuring OTA performance Devices with Transmit Antenna Switching
Date	15 February 2017

### Introduction

The CTIA Over-the-Air (OTA) Working Group would like to thank GSMA TSGAP for their recent LS entitled “Measuring OTA performance Devices with Transmit Antenna Switching”. CTIA would like to take this opportunity to provide the TSGAP with input concerning this topic.

### Discussion

The inclusion of antenna switching to improve a mobile device’s uplink antenna radiation efficiency was first brought to CTIA’s attention in August, 2013. Subsequently, the CTIA OTA Working Group developed and approved a methodology for the evaluation of devices which utilize multiple transmit antennas, and this test methodology was included in Version 3.4 of the CTIA Over the Air Test Plan [1]. This methodology has been maintained going forward, and is included in the current CTIA OTA Test Plan Version 3.6.1 [2].

As described by the relevant sections in [1] and [2], the CTIA test plan addresses two potential operational cases:

- a) Devices where the active TX antenna could change during execution of the radiated performance test cases
- b) Devices where the active TX antenna does not switch during the execution of the radiated performance test cases

In both of the operational cases above, the DUT manufacturer is expected to provide the CATL with information concerning the sensors which will affect antenna selection as well as information concerning the logic used to switch between antennas based on input from these sensors. CATLs are not expected to evaluate the RF performance of a device containing transmit antenna switching without this information from the DUT manufacturer.

In its LS, GSMA TSGAP has specifically requested assistance from CTIA towards the development of a test methodology which would apply to any DUT supporting switched-antenna transmit diversity regardless of whether the manufacturer has provided the information described above.

CTIA believes that the development of a spatial test methodology for devices employing switched transmit antennas which would not depend on UE manufacturer information would be very time consuming, and the uncertainty of the resulting methodology would be quite high. Since the trigger conditions and the responses would be tightly coupled to the environment presented to the UE, the spatial test methodology would have to take into account any foreseeable environmental condition and this would not be practical from a test complexity and test time perspective. Also, any such test methodology may result in the need to redesign existing phantoms to ensure that proximity sensors which are triggered by actual

human skin (as opposed to the head phantom material), are properly activated. Given the difficulties associated with designing a spatial test methodology for devices employing transmit antenna switching, CTIA believes that information from UE manufacturers concerning the details of their transmit antenna switching implementations is mandatory.

If spatial radiated performance results are not required from the DUT, the GSMA TSGAP should consider making TRP measurements using a reverberation chamber in the continuous-stirred mode. CTIA would like to point out that, like measurements made in an anechoic chamber, the reverberation chamber may introduce uncertainties which are difficult to quantify and will unknowingly affect the measurement results. For example, some devices may base antenna selection on downlink signal power, and the near-isotropic Rayleigh propagation environment present in the reverberation chamber could affect this selection process. Currently, CTIA recommends the use of spatial measurement techniques for DUTs which utilize switched-antenna transmit diversity, in which case information from the DUT manufacturer is required per [2]. However, if the GSMA TSGAP does not require spatial information for devices employing switched-antenna transmit diversity, the use of a continuously-stirred reverberation chamber for TRP measurements of devices employing transmit antenna switching may be a viable alternative if the potential uncertainties associated with this approach are considered. A suitable test methodology is available from CTIA (Large-Form-Factor Device OTA Test Plan V 1.0.1 [3]).

All test plans referenced here may be downloaded from:  
<http://www.ctia.org/initiatives/certification/certification-test-plans>.

#### Actions

None

#### Contact Info

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#### Date of Next CTIA OTA WG Meeting:

- 21 March, 2017, Teleconference
- 27 April, 2017, Face-to-Face, Sacramento, CA, USA

#### References:

- [1] CTIA Test Plan for Wireless Device Over-the-Air Performance, Version 3.4, December, 2014, Appendix O.7.8
- [2] CTIA Test Plan for Wireless Device Over-the-Air Performance, Version 3.6.1, November, 2016, Section 5.14
- [3] CTIA Test Plan for Wireless Large-Form-Factor Device Over-the-Air Performance, Version 1.0.1, October 2016